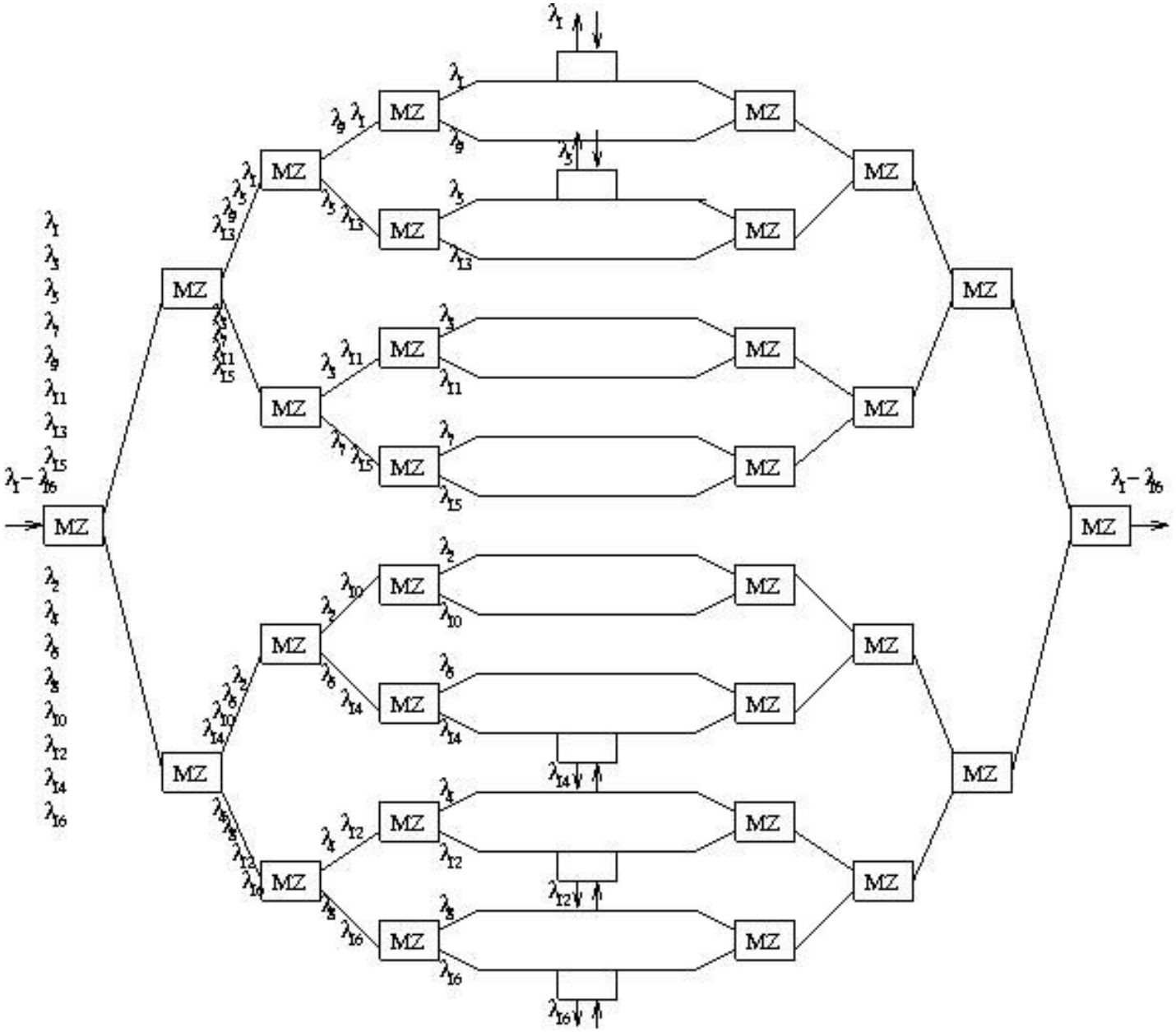
HW11 Solution

1) The design uses $(2^4-1)\times 2=30$ MZ interferometers and three 2x2 switches.



2) a) The 4x4 coupler shown during the lecture has 3 layers, i.e. each signal must pass through 3 2x2 switches.

Total loss per switch = 3dB + 0.3dB = 3.3dB

Coupling loss due to spliting of signals ← insertion loss

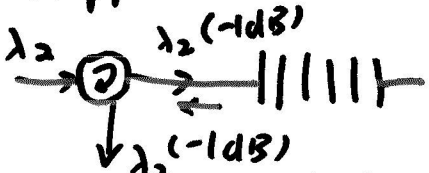
Loss of the 4x4 coupler = 3 × 3.3 = 9.9 (dB)

b) 256x256 star coupler is made up of an 128 x 8 array of switches, i.e. 8 layers ⇒ each signal passes through 8 switches.

Loss of the 256x256 couple = 8 × 3.3 dB = 26.4 dB.

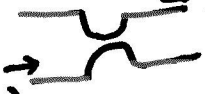
3) a) There are 3 cases needed to be considered:

1) Dropped channel, i.e. λ_2



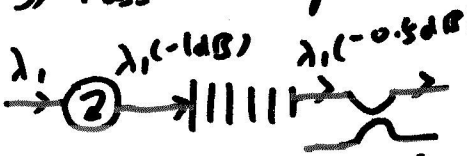
Loss (drop λ_2) = -1dB - 1dB = -2 dB

2) Added channel, i.e. λ_2



Loss (add λ_2) = $10 \log_{10}(0.15) = -8.239$ (dB)

3) Pass through channels i.e. λ_1 or λ_3



Loss (λ_1) = $-1 - 0.5 + 10 \log_{10}(0.85) = -2.206$ dB

Now input power for each λ is -10 dBm

Power for passing through λ = -10 - 2.206 = -12.206 (dBm)

We want to add λ_2 that has the same power as pass through λ_1.

⇒ P_{Tx} + loss (λ_2 add) (dB) = -12.206 ⇒ P_{Tx} = 8.239 - 12.206 = -3.967 (dBm)

b) We can add & drop 3 wavelengths by cascading the design in the textbook